# MODIS Cloud Optical and Microphysical Properties during CRYSTAL-FACE

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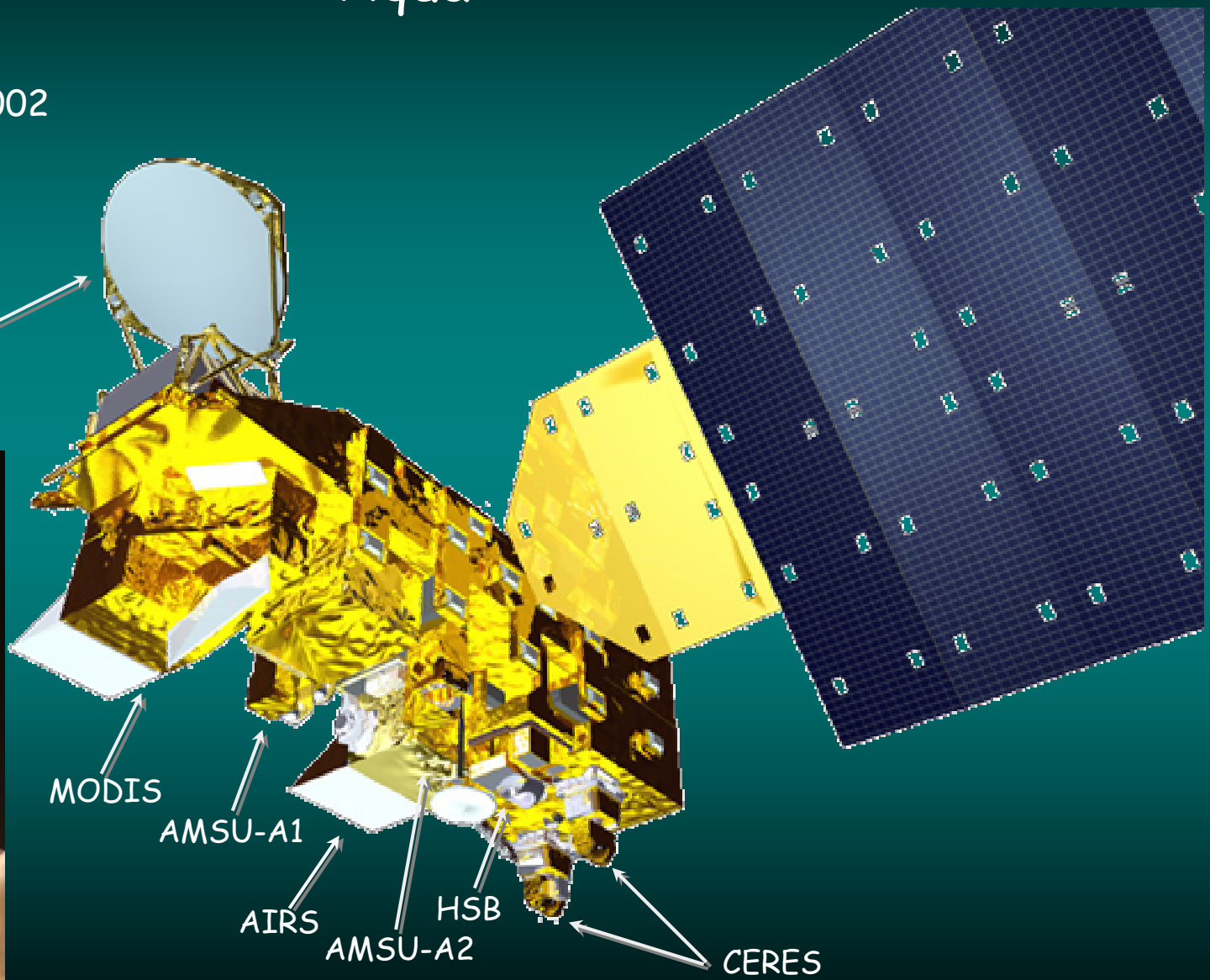
- Aqua
  - Remote sensing of the global water cycle
  - CRYSTAL-FACE first validation opportunity
- MODIS
  - Terra and Aqua
    - Cloud optical and microphysical properties
      - Intercomparison of spaceborne and airborne sensors
      - Intercomparison of spaceborne and surface instrumentation

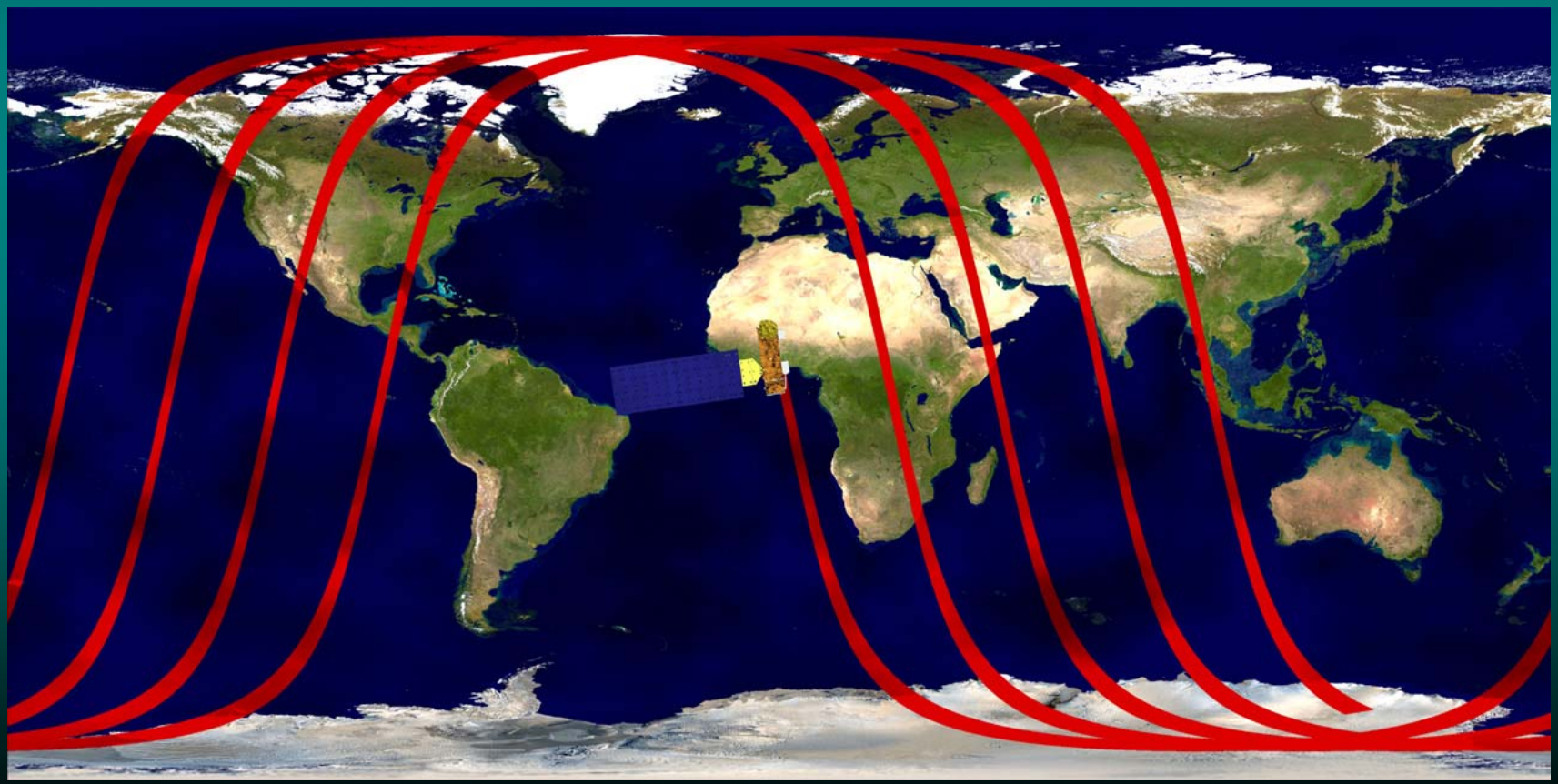
# Aqua

Launched May 4, 2002



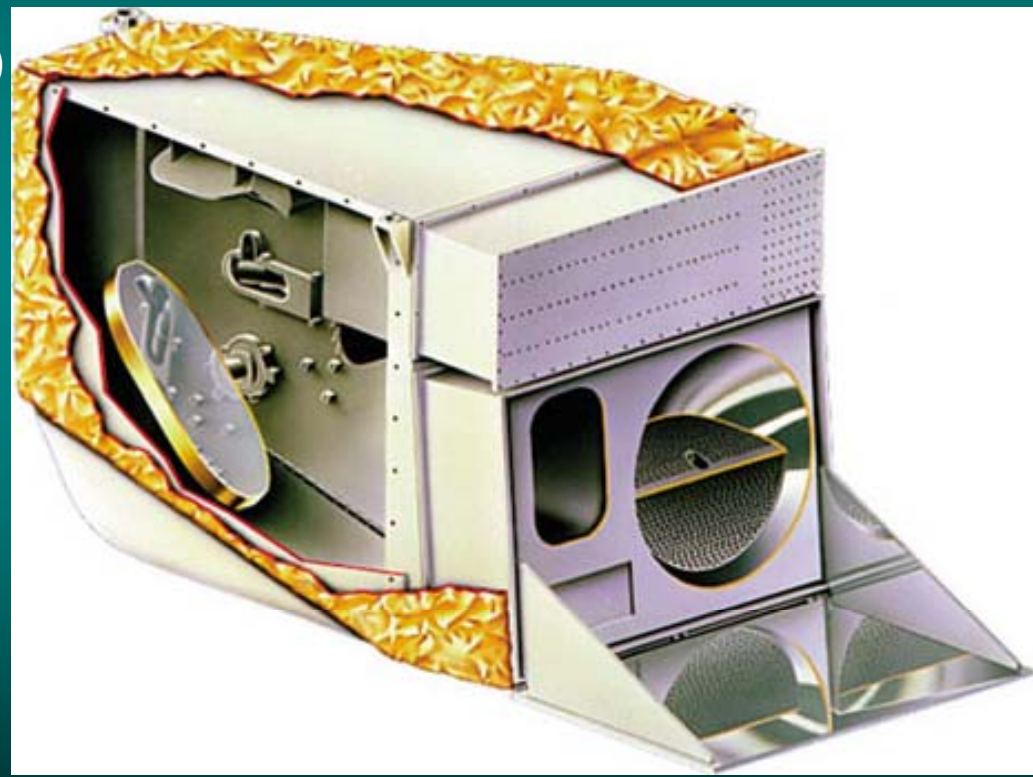
# Aqua's Orbit

- Altitude of 705 km
- Near-polar, sun-synchronous, orbiting the Earth every 98.8 minutes, crossing the equator going north at 1:30 p.m. and going south at 1:30 a.m.



# Moderate Resolution Imaging Spectroradiometer (MODIS)

- NASA, Terra & Aqua
  - launched 1999, 2002
  - 705 km polar orbits, descending (10:30 a.m.) & ascending (1:30 p.m.)
- Sensor Characteristics
  - 36 spectral bands ranging from 0.41 to 14.385 μm
  - cross-track scan mirror with 2330 km swath width
  - Spatial resolutions:
    - » 250 m (bands 1 - 2)
    - » 500 m (bands 3 - 7)
    - » 1000 m (bands 8 - 36)
  - 2% reflectance calibration accuracy
  - onboard solar diffuser & solar diffuser stability monitor



# Terra and Aqua Overpass Summary

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| | 1 | 2 | Aqua overpass Eastern Site 3 | 4 | 5 | 6 |
| 7 | 8 | Terra & Aqua flights off Mexico 9 | 10 | Terra overpass of Western Site 11 | 12 | Terra and Aqua overpass of Florida Bite 13 |
| 14 | 15 | 16 | 17 | 18 | Aqua coordination 19 | 20 |
| 21 | 22 | TRMM overpass of eastern ground site<br>Terra & Aqua overpass of Florida 23 | 24 | 25 | Aqua overpass off Mexico & Honduras 26 | 27 |
| Aqua overpass of Bahamas & convective clouds over Florida 28 | Terra overpass of Bahamas & convective clouds over Florida 29 | 30 | 31 | | | |

June 2002

| | | | | | | 1 |
|---|---|---|---|---|---|---|
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | | | | | | |

## July 2002

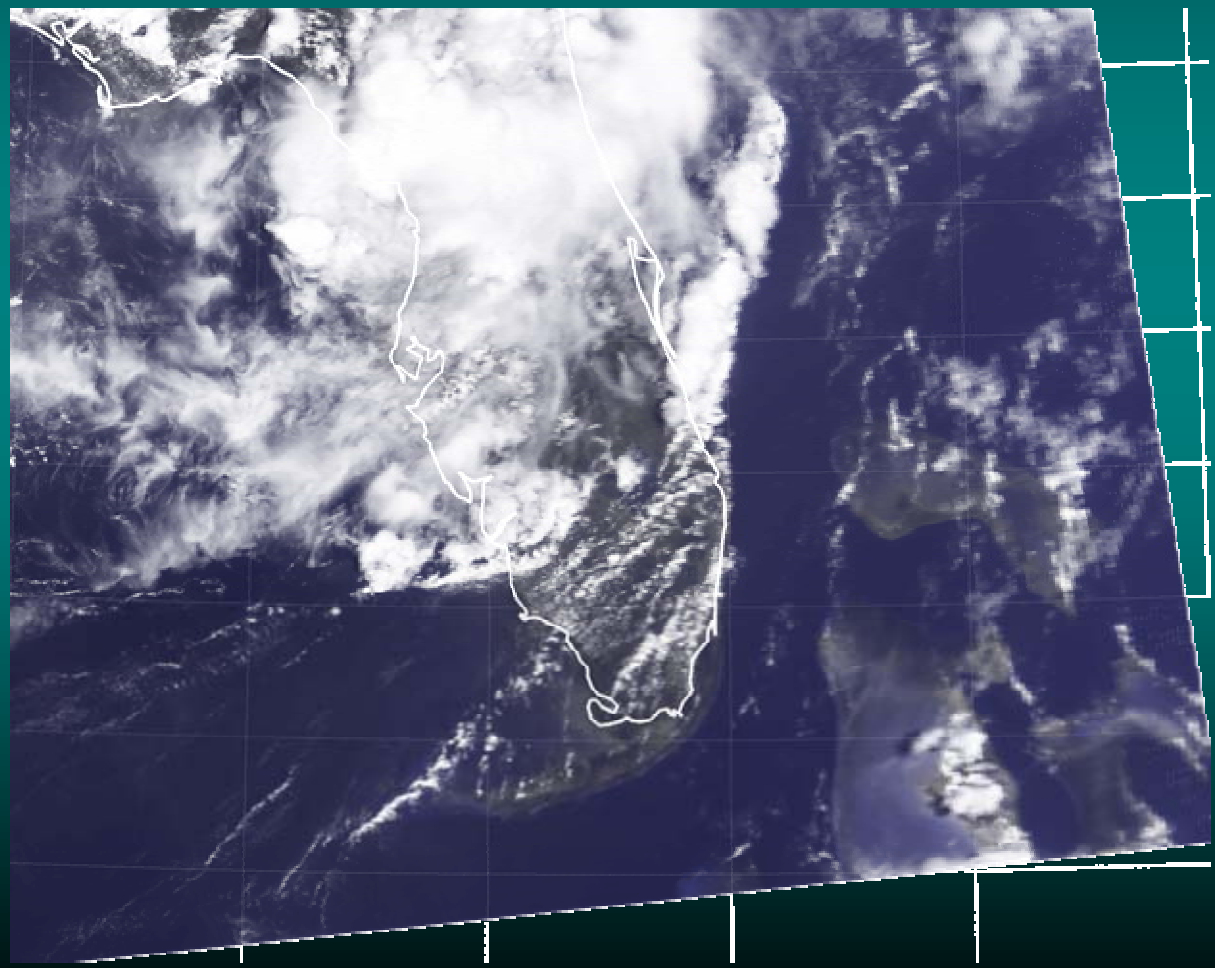
August 2002

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 |

# Aqua/MODIS Level-1B Image

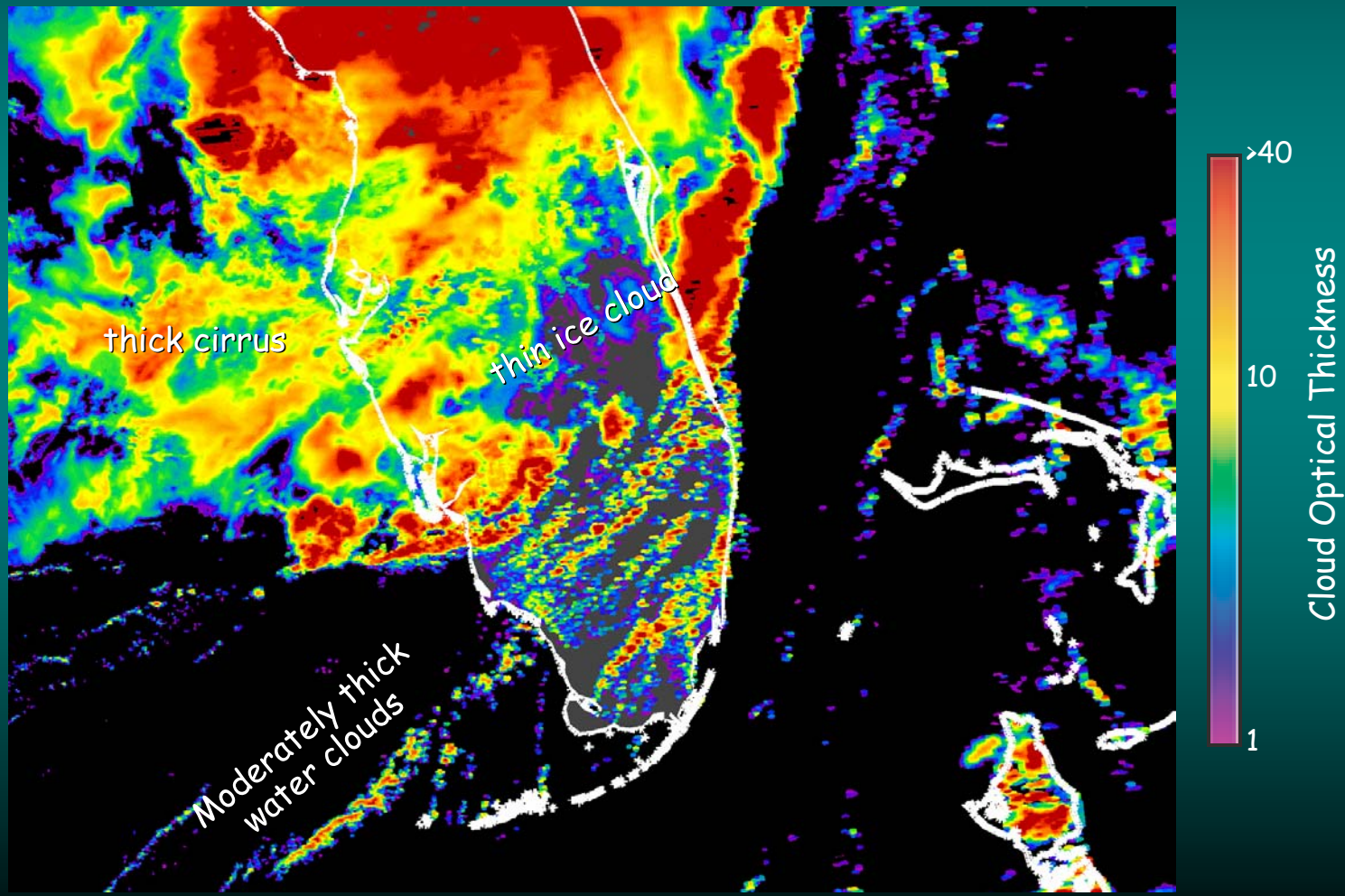
R = 0.65 μm
G = 0.56 μm
B = 0.47 μm

July 13, 2002
1910 UTC



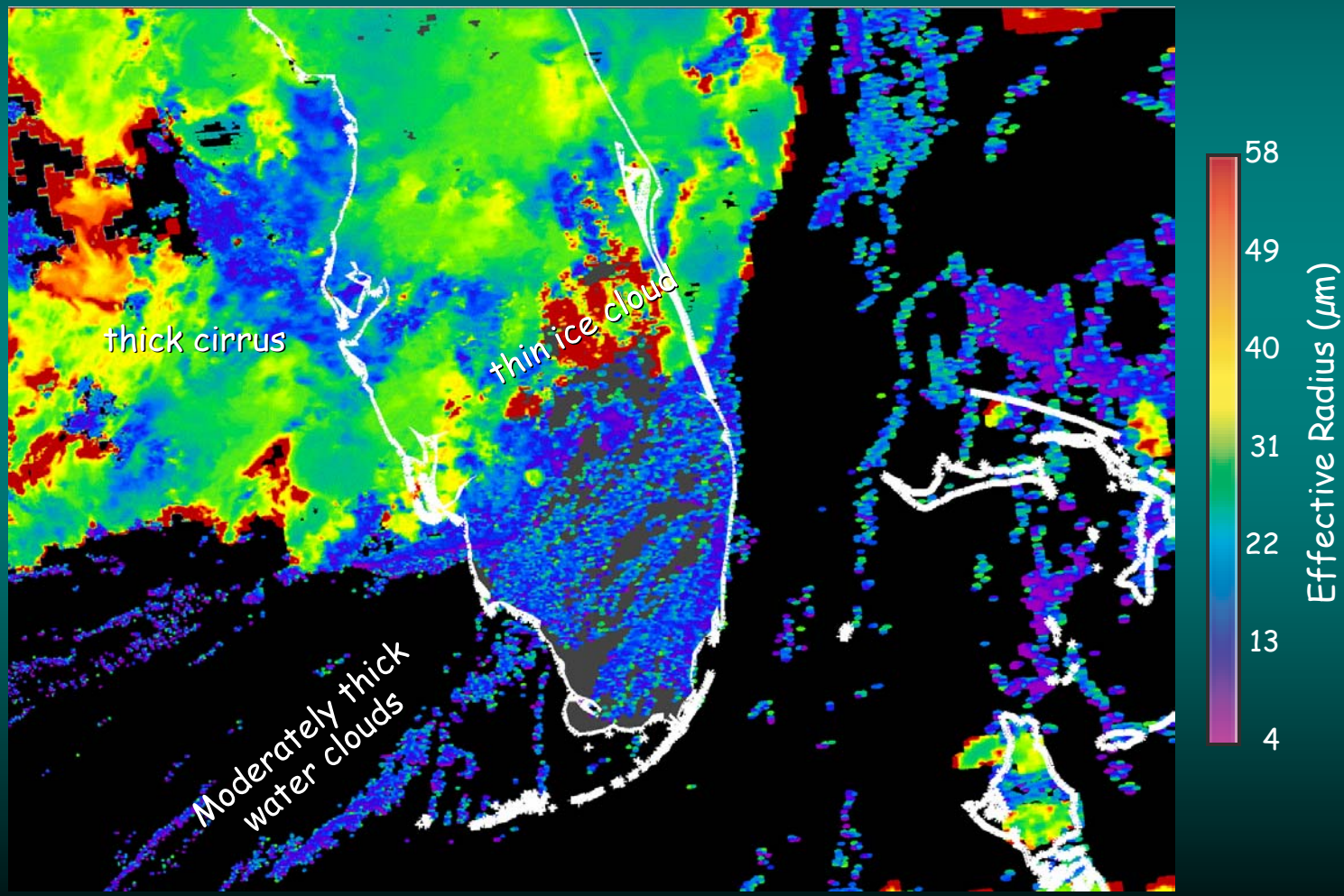
# Aqua/MODIS Retrieval of Cloud Optical Thickness

July 13, 2002
1910 UTC



# Aqua/MODIS Retrieval of Effective Radius

July 13, 2002
1910 UTC



# Aqua/MODIS Level-1B Image

R = 0.65 μm
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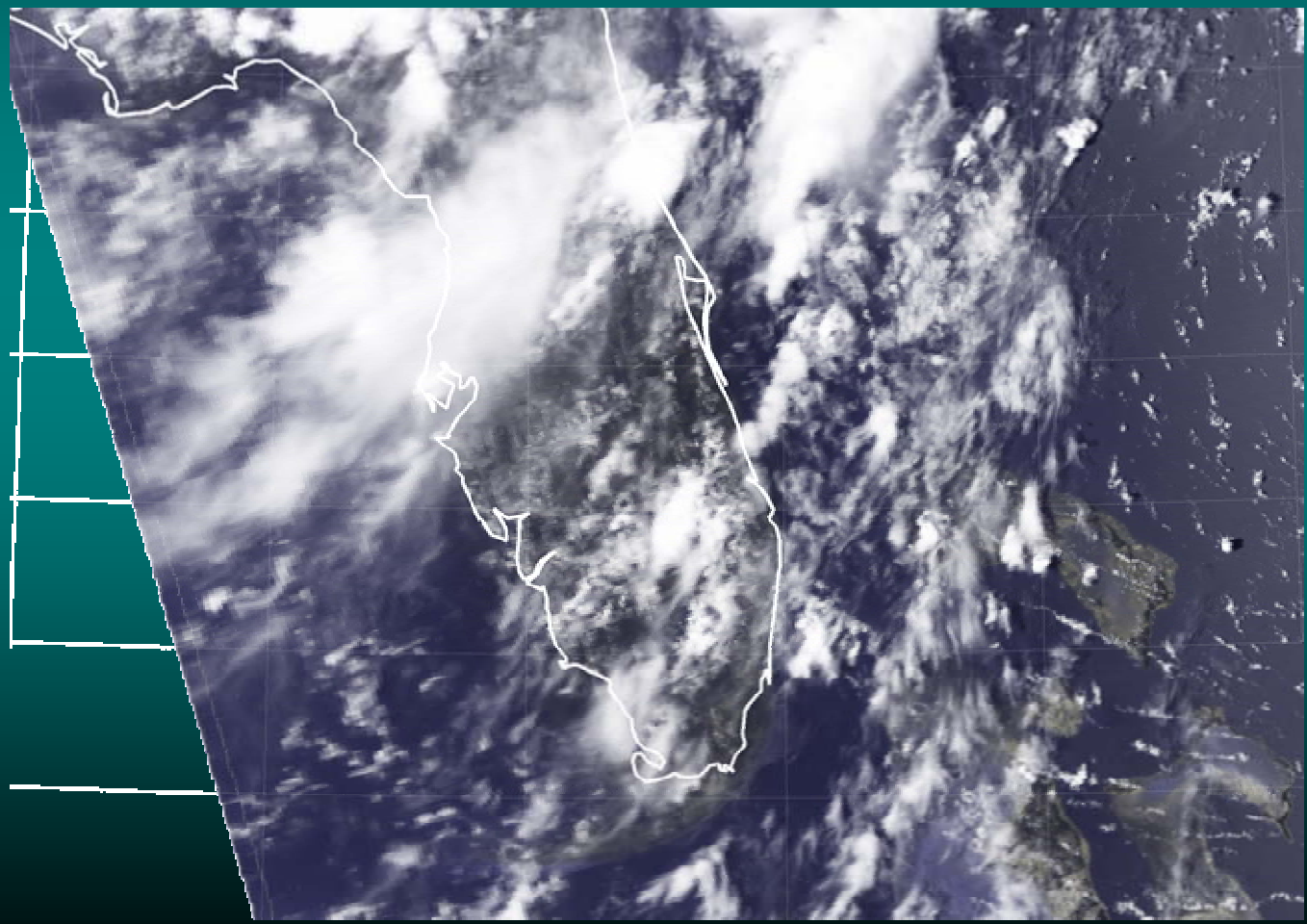
B = 0.47 μm

July 23, 2002
1805-1810 UTC



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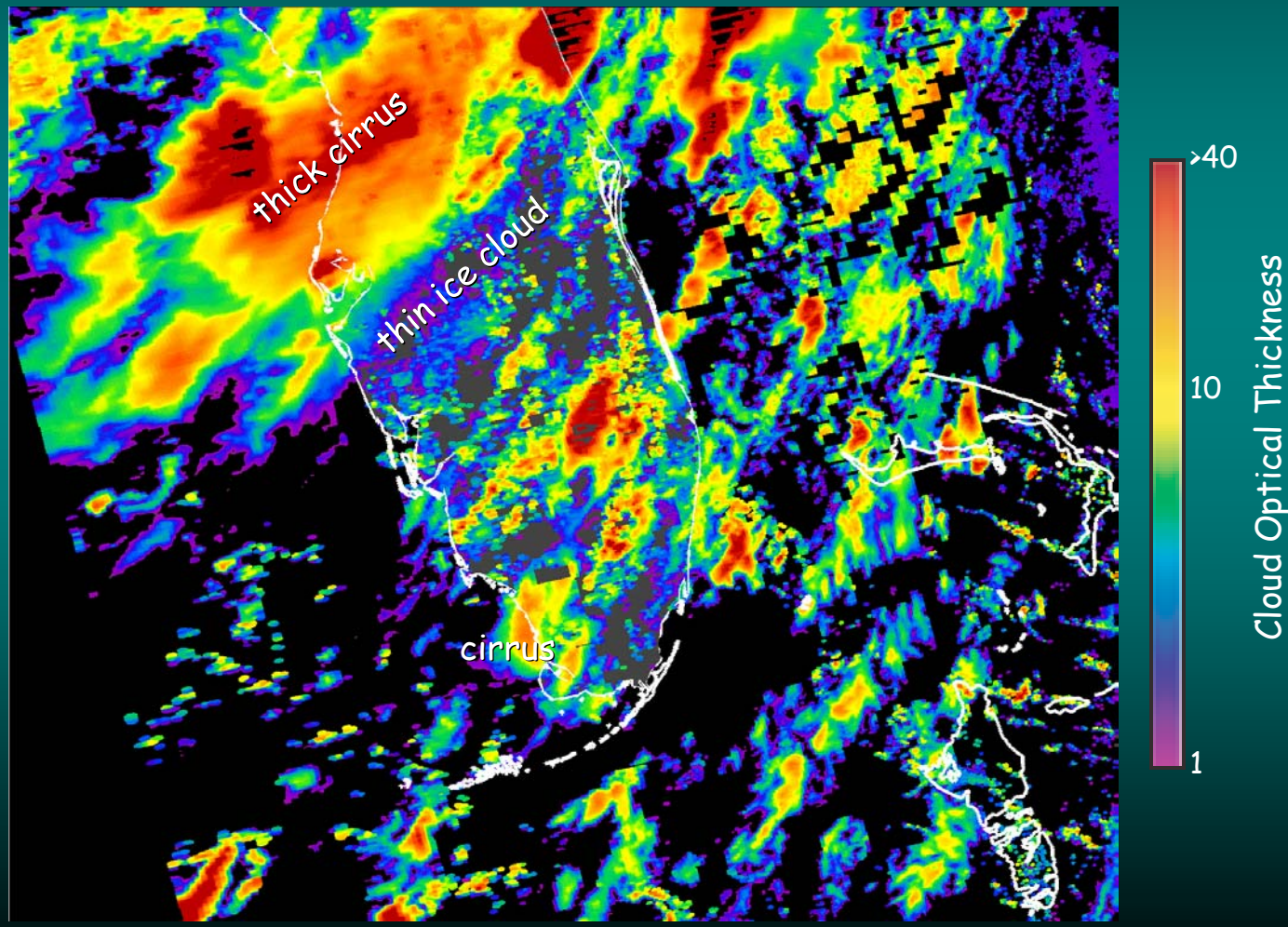
July 23, 2002
1805-1810 UTC



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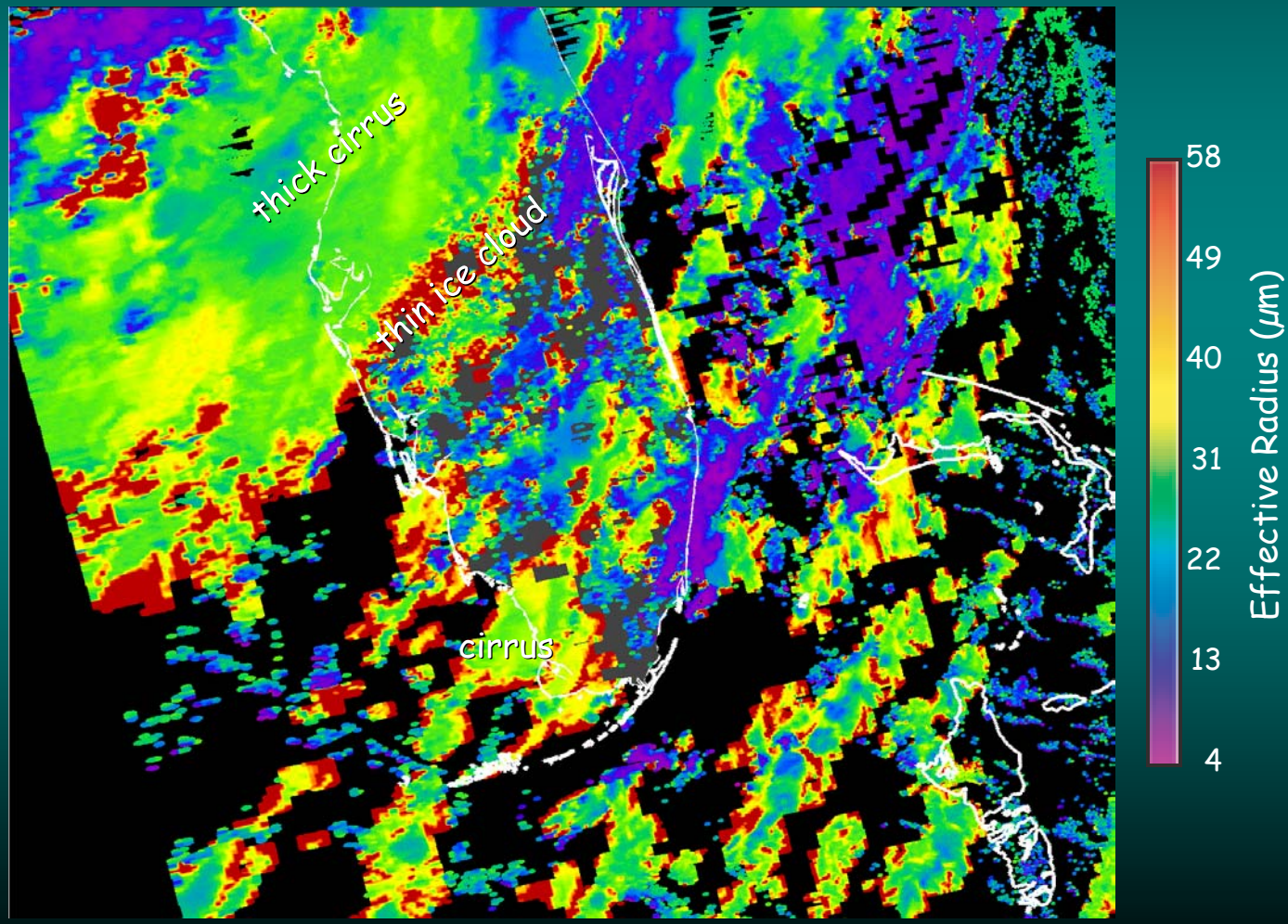

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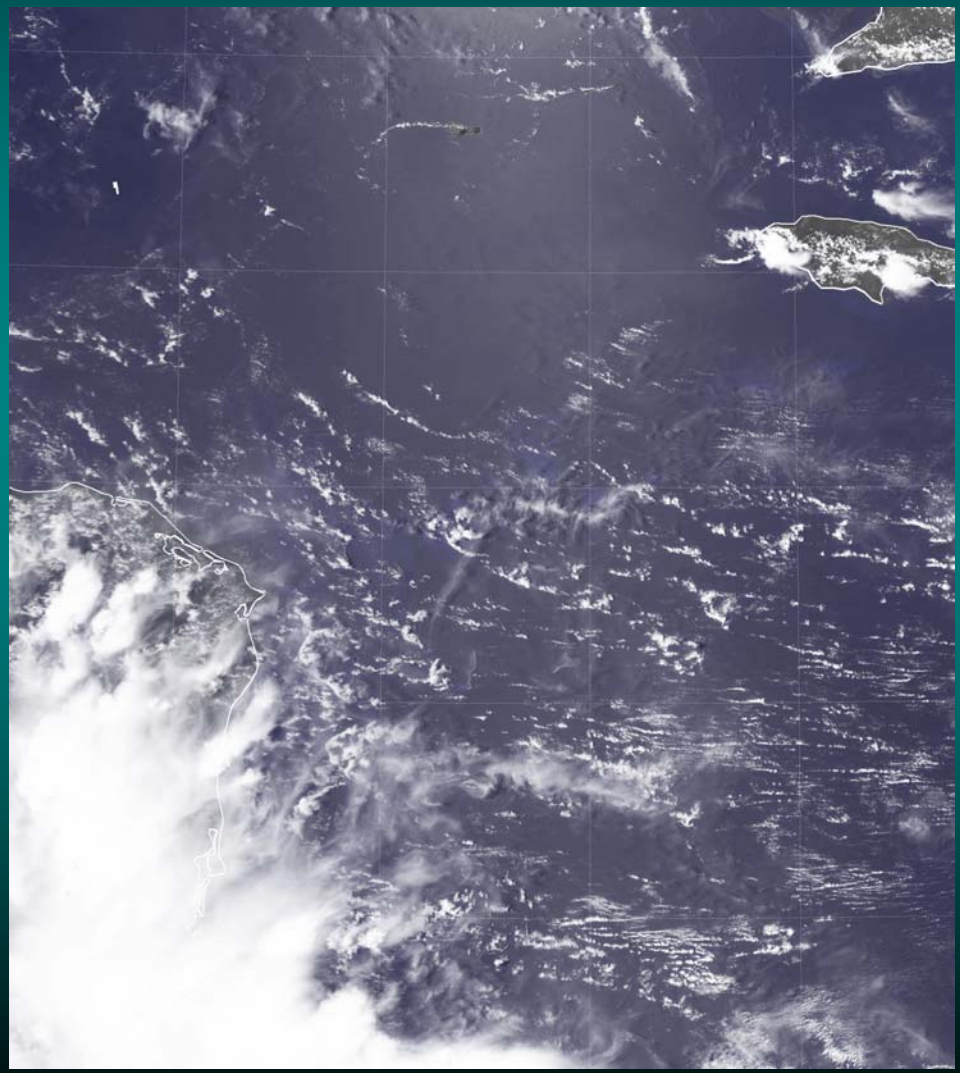
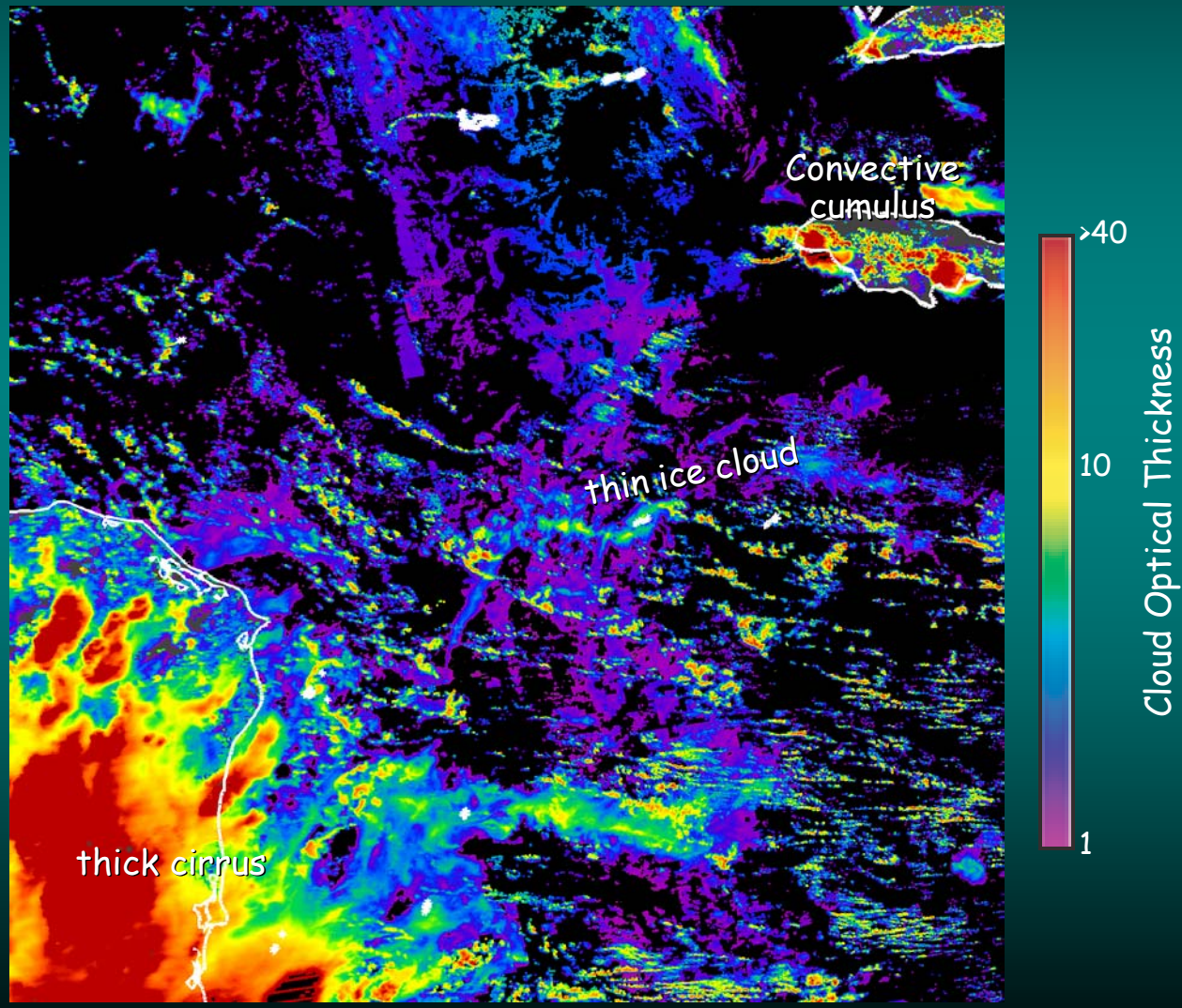


July 26, 2002
1835 UTC

# Aqua/MODIS Retrieval of Cloud Optical Thickness

July 26, 2002
1835 UTC



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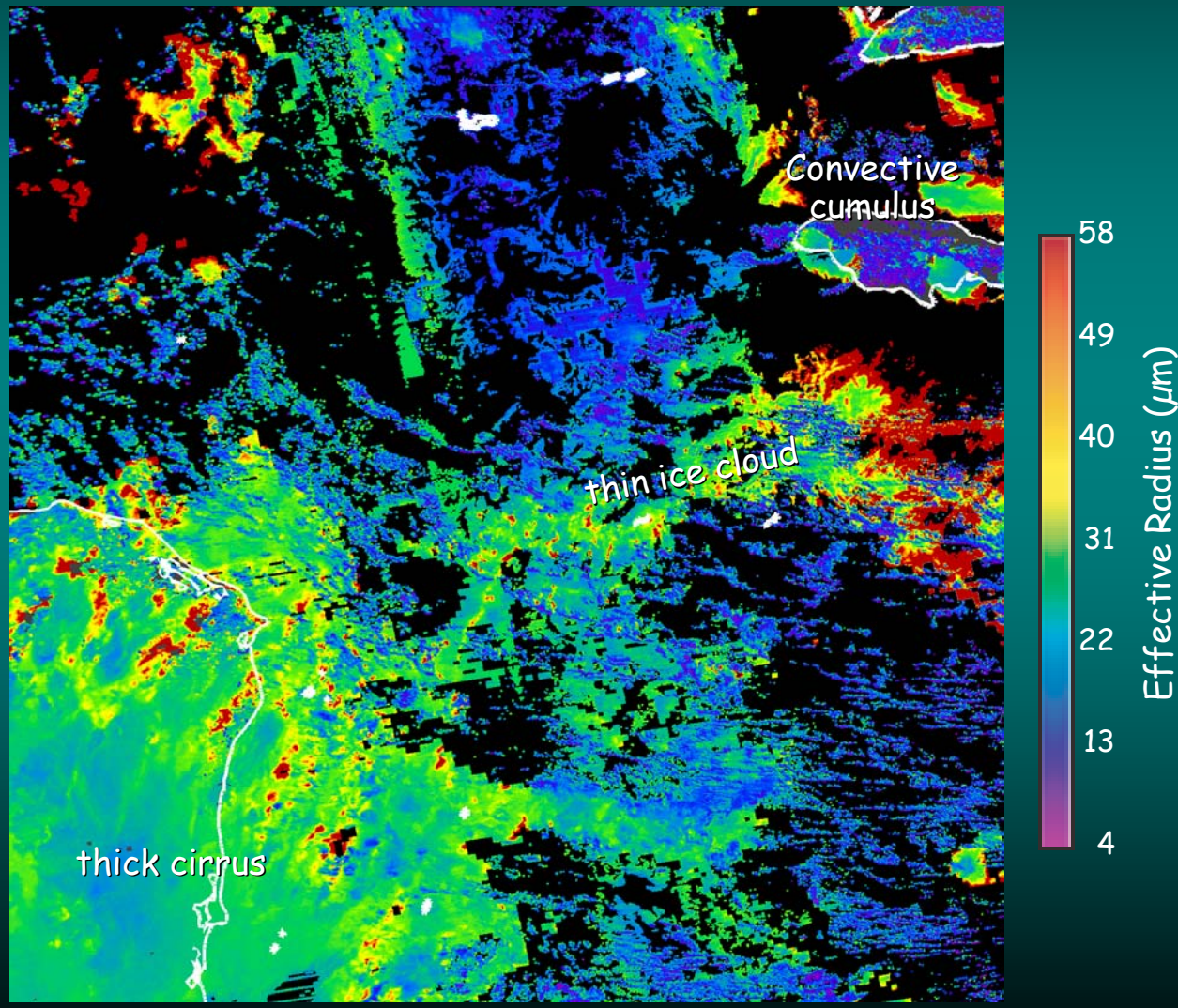
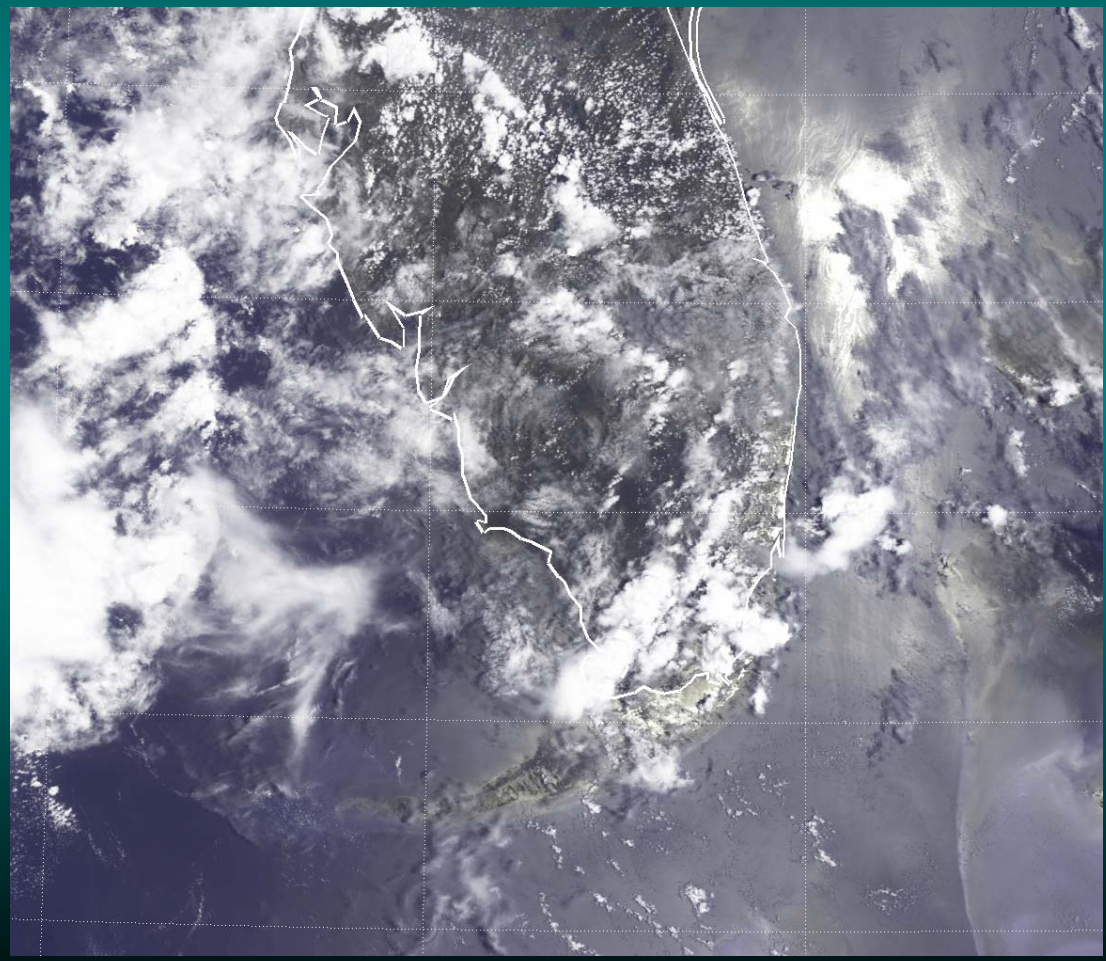
July 26, 2002
1835 UTC



# Terra/MODIS Level-1B Image

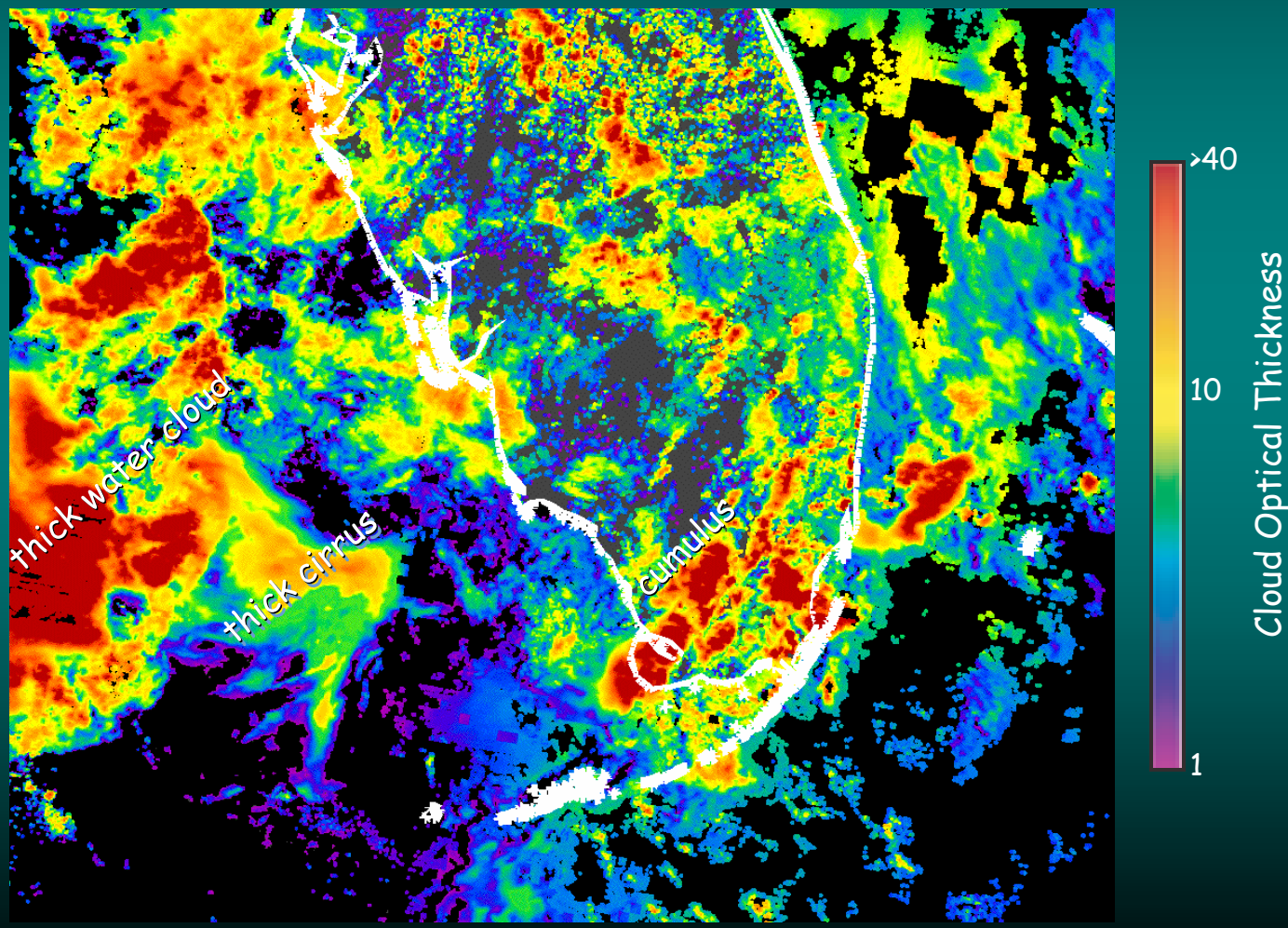
R = 0.65 μm
G = 0.56 μm
B = 0.47 μm

July 11, 2002
1610-1615 UTC



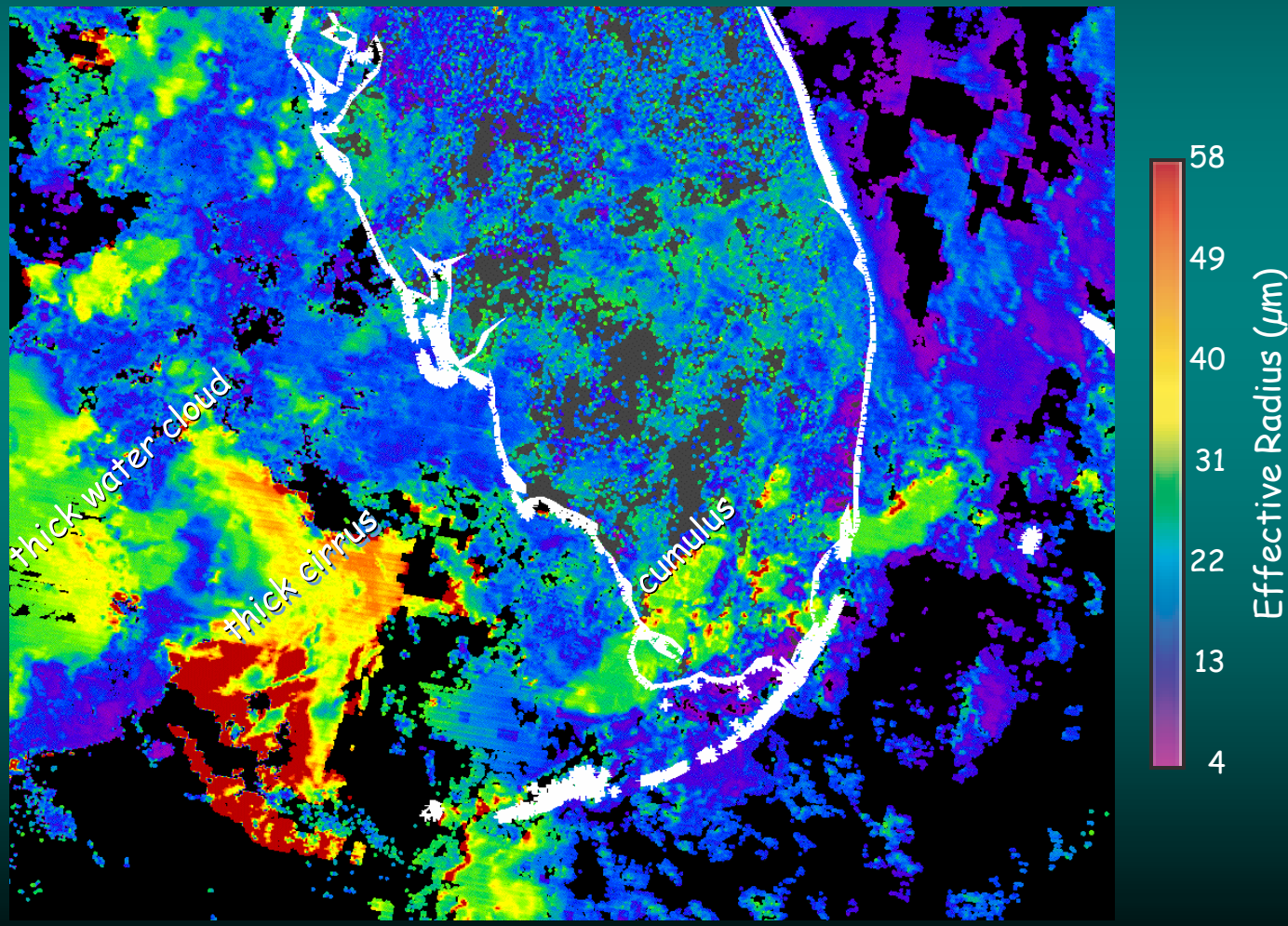
# Terra/MODIS Retrieval of Cloud Optical Thickness

July 11, 2002
1610-1615 UTC



# Terra/MODIS Retrieval of Effective Radius

July 11, 2002
1610-1615 UTC



# Summary

- During CRYSTAL-FACE, Aqua orbited at 1:30 pm in an ascending orbit (solar time) and Terra at 10:30 am in a descending orbit
  - Terra/MODIS acquired 6 scenes (one on a no-fly day for the ER-2)
  - Aqua/MODIS acquired 7 scenes
  - MODIS retrieved cloud optical and microphysical properties using the operational algorithm for cloud mask, thermodynamic phase, and optical and microphysical properties
- Aqua data are beta, whereas Terra data are of validation quality
  - Same algorithms used for processing both Terra and Aqua data
  - Aqua only opened its Earth-viewing covers on June 24, so the calibration of the instrument was still being evaluated until August 24—data will be reprocessed with new calibrations but all data are available to the public